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(54) **TAMPER-PROOF CONTAINER AND CAP ASSEMBLY**

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Description

BACKGROUND AND OBJECTS OF THE INVENTION:

The present invention relates to tamper-proof container and cap assemblies, such as molded plastic vials. It is desirable in certain instances to provide a container to which access can be gained only by producing visible evidence that the container has been opened. Such a container would be useful in the transportation and storage of liquid specimens for example, to ensure the integrity of the specimen. The integrity of the specimen in the vial is becoming increasingly important in the dairy industry and for drug testing. It is important to ensure the so-called "guaranteed chain of custody" of the container contents.

Various expedients have been heretofore proposed to achieve such a result. One proposal is disclosed in U.S. Patent No. 3,556,575 in which a string seal in the form of an elongated strip possesses conical teeth and an apertured head at one end of the strip. The strip can be inserted into a member to be sealed and then a tail end of the strip is inserted through the apertured head. The strip is pulled through the head until at least one tooth, formed of an elastic material, squeezes through the aperture. That tooth cannot pass back through the aperture without being permanently destroyed and thereby provides visible evidence of tampering. Such an arrangement, however, involves certain shortcomings, including the possibility that a person could break the original strip and then substitute a replacement strip after tampering with the container contents.

Furthermore, it is necessary that a user carry a supply of such strips for use when necessary. If the strips are forgotten or mislaid, a security lapse relating to the contents becomes possible.

Therefore, it is desirable to provide a tamper-proof container/cap assembly which ensures a greater degree of integrity of the container contents and which eliminates the need for a user to carry a supply of string seals.

It is further desirable to provide a tamper-proof container/cap assembly which is relatively inexpensive to manufacture and easy to use.

US 4782977 discloses a container formed of a base and a cover. The base section of the container carries hasps which pass through apertures in the cover. The hasps are designed so that they can pass through the apertures in only one direction.

BE 515115 discloses a plastic container attached via a hinge to a plastic cap wherein in the closed position a separate cord is passed through apertures in the cap and container and sealed.

NL 302929 discloses a cap comprising an integral strip, the strip being constructed so that it can pass through an aperture in the cap in only one direction.

FR 1471192 discloses a cap assembly comprising a first threaded portion which has a projection which clips into the opening of a container and a second threaded portion which screws onto the first portion. The first por-

tion carries a post which passes through an aperture in the second portion so that the second portion cannot be unscrewed without breaking the post.

The present invention provides a tamper-proof container and cap, said container including a first flange having a first through-hole, said cap including a second flange having a second through-hole, said second flange arranged to substantially overlie said first flange when said cap is inserted onto a rim of said container, one of said container and cap being formed in one piece together with an integral strip extending from a location adjacent said through-holes, said strip being of sufficient flexibility and length to enable said strip to be inserted through said substantially aligned through-holes while remaining attached to said one of said container and cap, said strip including portions configured for one-way passage through said through-holes, said container and cap being integrally molded together in one piece of plastic to form an integral hinge therebetween characterized in that said first and second flanges project radially outwardly from outer surfaces of said container and cap, respectively, and in that the through-holes have an axis oriented generally parallel to a common longitudinal axis of said container and cap.

In a preferred embodiment of the present invention the strip is integrally molded with the container.

The second flange on the cap preferably extends past the first flange to define a thumb tab which facilitates removal of the cap.

One of the flanges preferably includes a post arrangement for engaging the other flange in a manner opposing relative movement between the flanges in a direction laterally of the aligned axes of the through-holes.

The objects and advantages of the invention will become apparent from the following detailed description of preferred embodiments thereof in connection with the accompanying drawings in which like numerals designate like elements, and in which:

FIGURE 1 is a longitudinal sectional view through a plastic vial according to the present invention;

FIGURE 2 is a plan view of the vial with the cap unseated from the rim of the container;

FIGURE 3 is a side elevational view of the vial after the cap has been seated onto the container rim, and a locking strip has been inserted through aligned holes in a container flange and a cap flange;

FIGURE 4 is a fragmentary plan view of a modified vial according to the present invention with the cap in a closed condition;

FIGURE 5 is a fragmentary side elevational view of the modified container depicted in FIG. 4; and

FIGURE 6 is a side elevational view of an upper portion of a vial in accordance with a further modification of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION:

A tamper-proof plastic vial 10 comprises a container 12 and a cap 14 which are integrally molded of plastic. The cap and vial may be molded according to the process and mold disclosed in U.S. Patent Nos. 4,783,056 and 4,812,116, respectively. With such a process and mold, the entire vial, including the cap, container, and tamper-proof seal (to be described below) can be molded in a single operation.

The cap 14 is joined to the container by an integral hinge 16 about which the cap may swing between open and closed positions. In a closed position, the cap is press-fit to a rim 18 of the container 12.

The container 12 includes an integral flange 20 projecting radially outwardly from an outer surface 22 of the container at a location adjacent the rim 18.

The flange 20 possesses a through-hole 24, the axis 26 of which is disposed generally parallel to a longitudinal axis 28 of the container 12.

The cap 14 possesses a radially outwardly projecting flange 30 which includes a through-hole 32. The cap flange 30 is arranged to overlie and substantially seat upon the container flange 20 when the cap 14 is closed, whereby the through-holes 32, 24 become substantially coaxially aligned. However, slight misalignment of the through-holes will not detrimentally affect the function of the present invention. Preferably, the cap flange 30 is of such a length as to extend past the container flange 20 and thereby define a thumb tab 35 which facilitates opening of the cap 14.

In order to ensure that once the container has been filled with a sample or specimen the cap 14 cannot be removed without creating visual evidence of such removal, there is provided a destructible string seal in the form of a locking strip 40. The strip, which is integrally molded with an edge 42 of the container flange 20, includes a pointed shank 46 and a plurality of one-way teeth or flexible projections 44 which are configured to pass through the through-holes 32, 24 in one direction only. The teeth are preferably of conical shape and spaced along a cylindrical shank 46 of the strip. Alternatively, the teeth could be of any other suitable wedge-like shape. Various embodiments of locking strips have been proposed that are suitable for use with the container of the present invention.

The strip 40 is of sufficient flexibility and length to pass through the aligned holes 24, 32 while remaining joined to the flange 20 (see FIG. 3). Thus, once the cap 14 has been seated upon the rim of the container 12, a pointed free end 48 of the strip is inserted into either of the through-holes 24, 32 (e.g., upwardly into the through-hole 24 as depicted when the strip 40 is attached to the container flange 20), and then pulled through both through-holes, whereupon some or all of the teeth squeeze through the through-holes, due to the elastic nature of the plastic material, once pulled through, the teeth cannot pass back through the through-holes with-

out being permanently destroyed. Accordingly, evidence of any subsequent tampering of the container contents can be visibly detected. In order to test the sample or specimen in the container, it is necessary to cut the strip 40.

It will be appreciated that it is not possible to replace the locking strip once it has, been destroyed, since the locking strip is formed integrally with the container. Hence, it is not possible to defeat the tamper-proof capabilities of the invention by replacing an original string seal with a replacement string seal as is possible in connection with prior art devices in which the string seal is separate from both the container and the cap. Furthermore, it is not necessary for a user to carry a supply of strips since the integrally molded strip will always be available with the vial 10. The integral molding of the strip with the vial can be easily and inexpensively performed.

The locking strip not only provides a tamper-proof function, but also aids in preventing dislodgement of the cap during transport, since the strip is able to clamp the flanges tightly together. Thus, additional security against spillage of the container contents is provided.

It will be appreciated that the locking strip need not be molded integrally with the container, but could instead be integrally molded with the cap. In such a case, the locking strip would preferably be inserted first through the through-hole in the cap flange and pulled downwardly through the through-hole in the container flange. This arrangement leaves the string seal strip along the body of the container and may minimize interference by the strip during transport. Furthermore, it will also be appreciated that various arrangements of the flanges or equivalent structure could effectively accomplish the objects of the present invention, e.g., multiple through-holes or multiple flanges. An important element is the tamper-evident securement of the locking strip to one of the container or cap.

A further embodiment of the invention is depicted in FIGS. 4 and 5, wherein the reference numerals of corresponding elements of the vial are provided with a suffix "A". In this embodiment, the container flange 20A is provided with two integrally molded posts 50 which are upstanding from peripheral edges 52 of the container flange. Those posts 50 straddle the edges 42A of the cap flange 30A when the cap is inserted onto the container rim, so as to prevent relative lateral movement between the flanges in response to lateral impacts. That is, the posts oppose impacts directed laterally relative to the axis of the hole 24A which could produce relative lateral movement between the flanges. Such lateral movement could, in turn, lead to a shearing of the strip and/or an opening of the cap. In order to provide additional security as to the origin of the example or specimen in the vial, the posts 50 can be spot welded in a known manner to the cap flange 30A after the cap has been closed.

An additional preferred embodiment of the invention is depicted in FIG. 6, wherein the reference numerals of corresponding elements of the vial are provided with a suffix "B". In this embodiment, the cap flange 30B is posi-

tioned adjacent the top of the cap generally in the plane of the upper surfaces of the cap 14B, whereby a space 60 is formed between the cap flange 30B and the container flange 20B after the cap 14B has been inserted onto the container rim. The presence of such a space provides more convenient access to the strip 40B in order to cut the strip when the vial is to be opened. In such an embodiment, the presence of posts 50B is particularly advantageous in order to resist inadvertent opening of the cap in response to the application of lateral impact to the cap flange 30B.

Although, the present invention has been described in connection with preferred embodiments thereof, it will be appreciated by those skilled in the art that additions, modifications, substitutions, and deletions not specifically described may be made without departing from the invention as defined in the appended claims.

Claims

1. A tamper-proof container (12) and cap (14), said container including a first flange (20) having a first through-hole (24), said cap including a second flange (30) having a second through-hole (32), said second flange arranged to substantially overlies said first flange when said cap is inserted onto a rim (18) of said container, one of said container and cap being formed in one piece together with an integral strip (40) extending from a location adjacent said through-holes, said strip being of sufficient flexibility and length to enable said strip to be inserted through said substantially aligned through-holes while remaining attached to said one of said container and cap, said strip including portions (44) configured for one-way passage through said through-holes, said container and cap being integrally molded together in one piece of plastic to form an integral hinge (16) therebetween characterized in that said first and second flanges project radially outwardly from outer surfaces of said container (22) and cap, respectively, and in that the through-holes have an axis oriented generally parallel to a common longitudinal axis (28) of said container and cap.
2. A tamper-proof container (12) and cap (14) according to claim 1, wherein said strip (40) is integrally formed of one piece with said container.
3. A tamper-proof container (12) and cap (14) according to claim 1, wherein said strip (40) is integrally formed with said cap.
4. A tamper-proof container (12) and cap (14) according to claim 1, 2 or 3, wherein said portions (44) comprise teeth of generally conical shape.
5. A tamper-proof container (12) and cap (14) according to claim 1, wherein said strip (40) is integrally formed with one of said flanges (20,30).

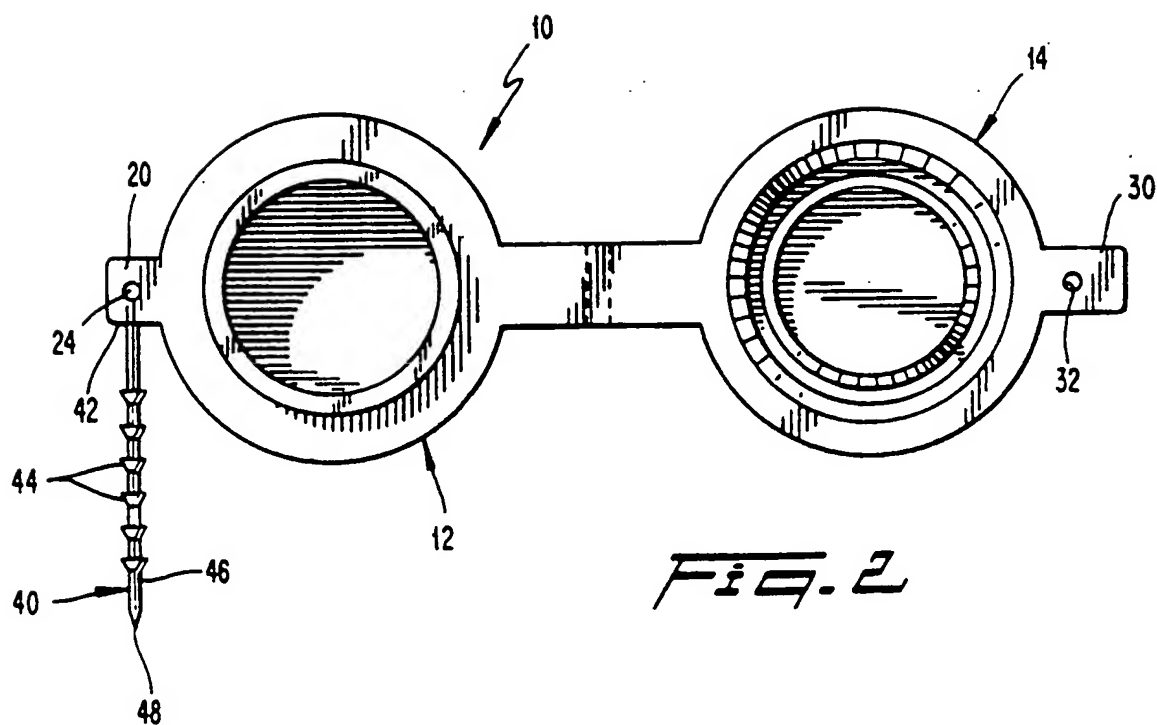
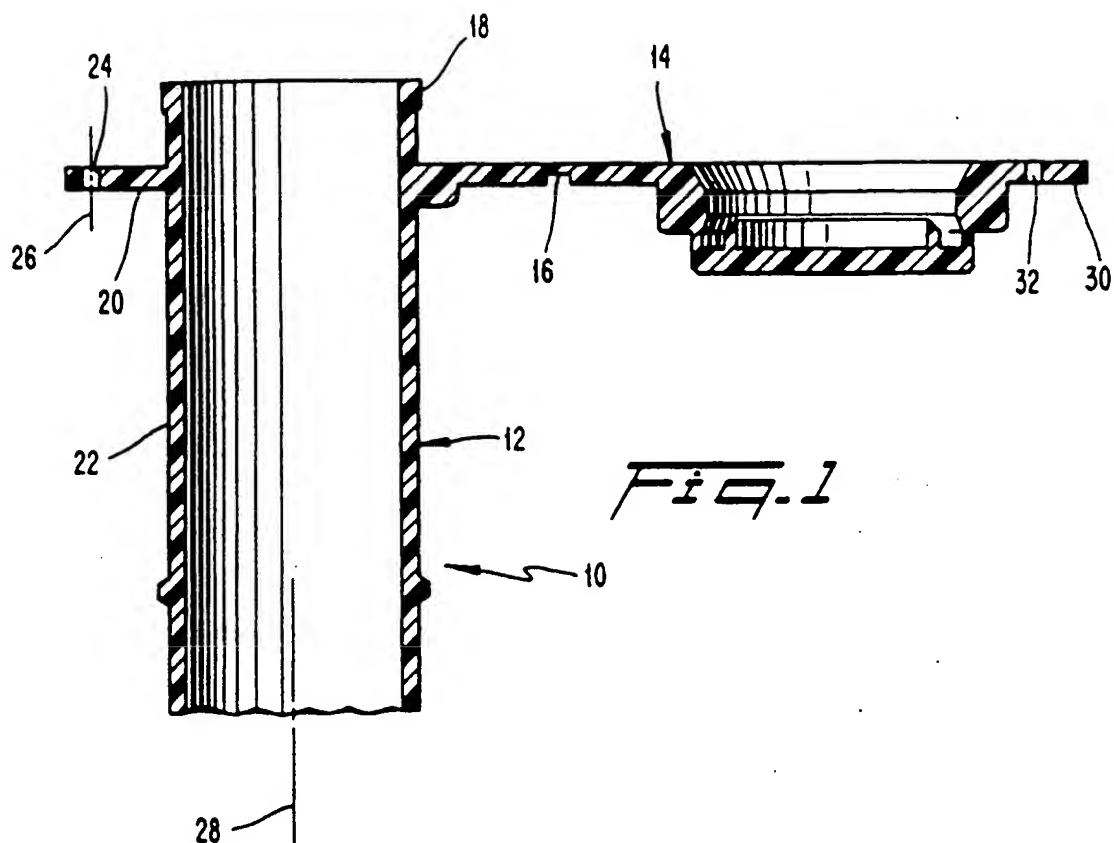
6. A tamper-proof container (12) and cap (14) according to any one of the preceding claims, wherein one of said flanges (20) includes post means (50) engaging the other flange (30) in a manner opposing relative movement between said flanges in a direction laterally of the axes of said through-holes (24,32).
7. A tamper-proof container (12) and cap (14) according to claim 6, wherein said post means (50) comprises a pair of posts engaging respective outer edges (42) of said other flange (30).
8. A tamper-proof container (12) and cap (14) according to claim 1, wherein one end of said strip (40) projects from an edge (52,42) of the flange (20,30) associated with said one of said container and cap.
9. A tamper-proof container (12) and cap (14) according to claim 8, wherein the other end (48) of said strip (40) is pointed.
10. A tamper-proof container (12) and cap (14) according to any one the preceding claims, wherein said second flange (30) extends past said first flange (20) when said second flange overlies said first flange, whereby said second flange defines a thumb tab (35) for facilitating opening of said cap.
11. A tamper-proof container (12) and cap (14) according to any one the preceding claims, wherein a space (60) is formed between said flanges (20,30) when said cap is seated on said container to facilitate cutting of said strip (40).
12. A tamper-proof container (12) and cap (14) according to claim 11, wherein one of said flanges (20) includes post means (50) engaging the other flange (30) in a manner opposing relative movement between said flanges in a direction laterally of the axes of said through-holes (24,32).
13. A tamper-proof container (12) and cap (14) according to claim 12, wherein said post means (50) are secured to said other flange (30) when said cap is closed.

Patentansprüche

1. Eingriffssicherer Behälter (12) mit Kappe (14), wobei der Behälter einen ersten Flansch (20) mit einem ersten Durchlaß (24) aufweist, die Kappe einen zweiten Flansch (30) mit einem zweiten Durchlaß (32) aufweist, der zweite Flansch so angeordnet ist, daß er im wesentlichen über dem ersten Flansch liegt, wenn die Kappe auf einen Rand (18) des Behälters aufgesetzt ist, entweder der Behälter oder die Kappe einstückig mit einem Streifen (40) ausgebildet ist, der sich von einer Stelle nahe den Durchlässen erstreckt, der Streifen ausreichend fle-

- xibel und lang ist, um zu ermöglichen, daß der Streifen durch die im wesentlichen ausgerichteten Durchlässe eingesetzt wird, während er entweder am Behälter oder an der Kappe befestigt bleibt, der streifen Abschnitte (44) aufweist, die so geformt sind, daß sie nur in einer Richtung durch die Durchlässe durchtreten können, der Behälter und die Kappe in einem Stück aus Kunststoff geformt sind, um ein einstückiges Gelenk (16) zwischen denselben zu bilden, dadurch gekennzeichnet, daß der erste und zweite Flansch von den Außenflächen von Behälter (22) bzw. Kappe radial nach außen ragen und daß die Durchlässe eine Achse aufweisen, die allgemein parallel zu einer gemeinsamen Längsachse (28) von Behälter und Kappe ausgerichtet sind.
2. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 1, bei welcher der Streifen (40) einstückig mit dem Behälter geformt ist.
 3. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 1, bei welchem der Streifen (40) einstückig mit der Kappe geformt ist.
 4. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 1, 2 oder 3, bei welchem die Abschnitte (44) aus Zähnen mit allgemein konischer Form bestehen.
 5. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 1, bei welchem der Streifen (40) einstückig mit einem der Flansche (20,30) geformt ist.
 6. Eingriffssicherer Behälter (12) mit Kappe (14) nach einem der vorangehenden Ansprüche, bei welchem einer der Flansche (20) Zapfen (50) aufweist, die in den anderen Flansch (30) in einer Weise eingreifen, daß sie einer Relativbewegung zwischen den Flanschen in einer Richtung seitlich zu den Achsen der Durchlässe (24,32) sich entgegensetzen.
 7. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 6, bei welchem die Zapfen (50) aus einem Paar von Zapfen bestehen, die jeweils an äußeren Rändern (42) des anderen Flansches (30) eingreifen.
 8. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 1, bei welchem das eine Ende des Streifens (40) aus einem Rand (52,42) des Flansches (20,30) vorsteht, welcher dem Behälter bzw. der Kappe zugeordnet ist.
 9. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 8, bei welchem das andere Ende (48) des Streifens (40) zugespitzt ist.
 10. Eingriffssicherer Behälter (12) mit Kappe (14) nach einem der vorangehenden Ansprüche, bei welchem der zweite Flansch (30) sich über den ersten Flansch (20) hinaus erstreckt, wenn der zweite Flansch über dem ersten Flansch liegt, wodurch der zweite Flansch einen Daumenvorsprung (35) zur Erleichterung des Öffnens der Kappe bildet.
 11. Eingriffssicherer Behälter (12) mit Kappe (14) nach einem der vorangehenden Ansprüche, bei welchem ein Zwischenraum (60) zwischen den Flanschen (20,30) gebildet ist, wenn die Kappe auf dem Behälter sitzt, um ein Schneiden des Streifens (40) zu erleichtern.
 12. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 11, bei welchem einer der Flansche (20) Zapfen (50) aufweist, die in den anderen Flansch (30) in einer Weise eingreifen, daß sie einer Relativbewegung zwischen den Flanschen in einer Richtung seitlich zu den Achsen der Durchlässe (24,32) sich entgegensetzen.
 13. Eingriffssicherer Behälter (12) mit Kappe (14) nach Anspruch 12, bei welchem die Zapfen (50) am anderen Flansch (30) befestigt sind, wenn die Kappe geschlossen ist.
- ### Revendications
1. Récipient (12) et bouchon (14) inviolables, ledit récipient comprenant une première collerette (20) traversée d'un premier trou (24), ledit bouchon comprenant une seconde collerette (30) traversée d'un second trou (32), ladite seconde collerette étant disposée de façon à s'étendre sensiblement sur ladite première collerette lorsque ledit bouchon est inséré sur un rebord (18) dudit récipient, un premier dudit récipient et dudit bouchon étant formé d'une seule pièce avec une bande intégrée (40) s'étendant depuis un emplacement adjacent auxdits trous traversants, ladite bande étant d'une flexibilité et une longueur suffisantes pour permettre à ladite bande d'être insérée dans lesdits trous traversants sensiblement alignés tout en restant reliée audit premier dudit récipient et dudit bouchon, ladite bande comprenant des parties (44) configurées de façon à passer dans un seul sens à travers lesdits trous traversants, ledit récipient et ledit bouchon étant moulés intégralement ensemble d'une seule pièce en matière plastique pour former entre eux une charnière intégrée (16), caractérisé en ce que lesdites première et seconde collerettes font saillie radialement vers l'extérieur de surfaces extérieures dudit récipient (22) et dudit bouchon respectivement, et en ce que les trous traversants ont un axe orienté à peu près parallèlement à un axe longitudinal commun (28) dudit récipient et dudit bouchon.

2. Récipient (12) et bouchon (14) inviolables selon la revendication 1, dans lesquels ladite bande (40) est formée intégralement d'une seule pièce avec ledit récipient. 5
3. Récipient (12) et bouchon (14) inviolables selon la revendication 1, dans lesquels ladite bande (40) est formée intégralement avec ledit bouchon.
4. Récipient (12) et bouchon (14) inviolables selon la revendication 1, 2 ou 3, dans lesquels lesdites parties (44) comportent des dents de forme globalement conique. 10
5. Récipient (12) et bouchon (14) inviolables selon la revendication 1, dans lesquels ladite bande (40) est formée de façon intégrée avec l'une desdites collerettes (20, 30). 15
6. Récipient (12) et bouchon (14) inviolables selon l'une quelconque des revendications précédentes, dans lesquels l'une desdites collerettes (20) comprend des moyens à ergots (50) engageant l'autre collerette (30) d'une manière s'opposant à un mouvement relatif entre lesdites collerettes dans une direction latérale aux axes desdits trous traversants (24, 32). 20 25
7. Récipient (12) et bouchon (14) inviolables selon la revendication 6, dans lesquels lesdits moyens à ergots (50) comprennent deux ergots engageant des bords extérieurs respectifs (42) de ladite autre collerette (30). 30
8. Récipient (12) et bouchon (14) inviolables selon la revendication 1, dans lesquels une extrémité de ladite bande (40) fait saillie d'un bord (52, 42) de la collerette (20, 30) associée audit premier dudit récipient et dudit bouchon. 35 40
9. Récipient (12) et bouchon (14) inviolables selon la revendication 8, dans lesquels l'autre extrémité (48) de ladite bande (40) est pointue.
10. Récipient (12) et bouchon (14) inviolables selon l'une quelconque des revendications précédentes, dans lesquels ladite seconde collerette (30) s'étend au-delà de ladite première collerette (20) lorsque ladite seconde collerette s'étend au-dessus de ladite première collerette, grâce à quoi ladite seconde collerette définit une languette (35) pour le pouce afin de faciliter l'ouverture dudit bouchon. 45 50
11. Récipient (12) et bouchon (14) inviolables selon l'une quelconque des revendications précédentes, dans lesquels un espace (60) est formé entre lesdites collerettes (20, 30) lorsque ledit bouchon est logé sur ledit récipient afin de faciliter la coupe de ladite bande (40). 55
12. Récipient (12) et bouchon (14) inviolables selon la revendication 11, dans lesquels l'une desdites collerettes (20) comprend des moyens à ergots (50) engageant l'autre collerette (30) d'une manière s'opposant à un mouvement relatif entre lesdites collerettes dans une direction latérale aux axes desdits trous traversants (24, 32).
13. Récipient (12) et bouchon (14) inviolables selon la revendication 12, dans lesquels lesdits moyens à ergots (50) sont fixés à ladite autre collerette (30) lorsque ledit bouchon est fermé.



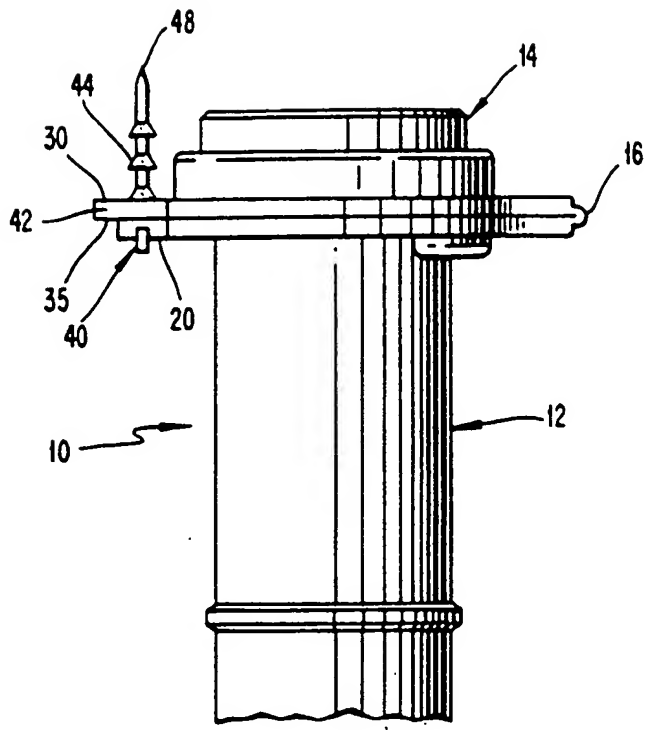


Fig. 3

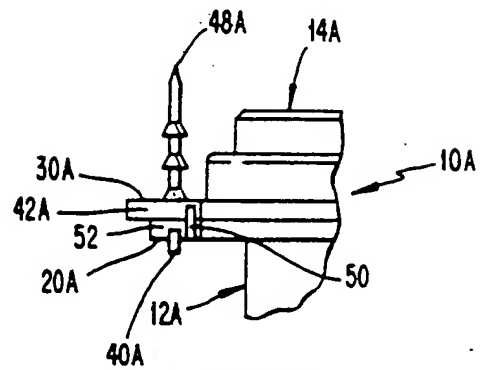
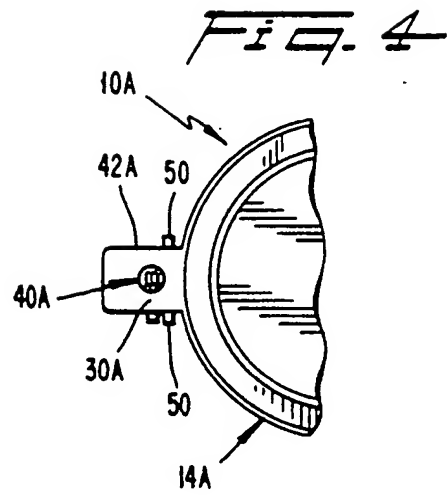


Fig. 5

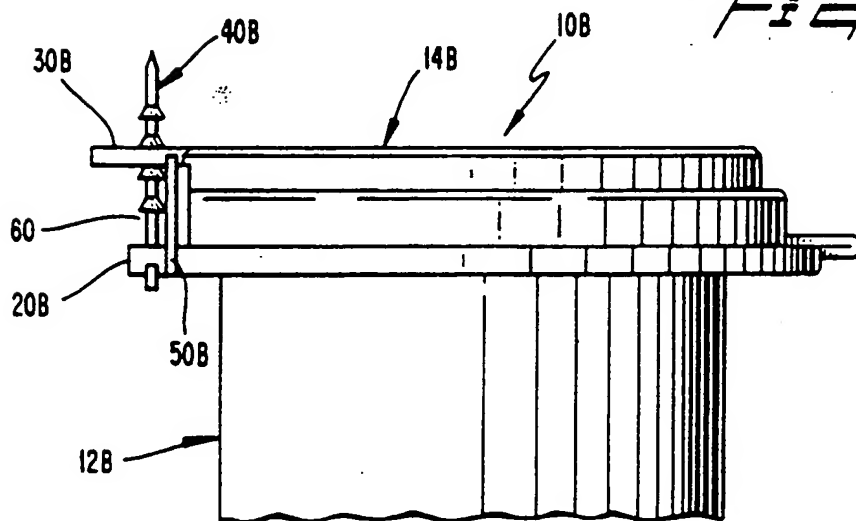


Fig. 6